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Electrodeposited Inorganic Separators for Alkaline Batteries

The problem:

To design a thin separator for alkaline batteries which is resistant to oxidation, is thermally stable, and permits more convenient assembly of cells than prior techniques.

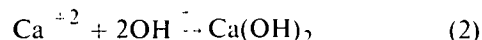
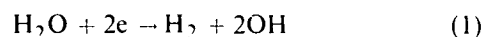
The solution:

Coating the electrodes of silver-cadmium cells with thermostable electrodeposits of calcium hydroxide or magnesium hydroxide. The coating results from the increase in pH at an electrode upon cathodic evolution of hydrogen from a solution of a soluble salt (such as nitrate or acetate) of calcium or magnesium. Migration of silver and the thickness of separators are reduced. Because of the absence of organic matter, assembled cells may be sterilized without oxidation of the material of the separators. When the new separators are used in addition to conventional separators, the cell's life is greatly increased by the reduction in migration of silver.

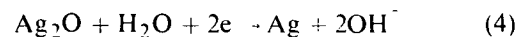
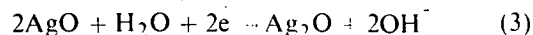
How it's done:

The cathode of the electrode to be coated (TBC) is placed in a solution of the calcium or magnesium salt; the counter electrodes, opposing each face of the TBC electrode, may be of platinum, nickel, or stainless steel. Passage of electric current between the electrodes evolves hydrogen, and the solution immediately adjacent to the cathode becomes alkaline. When the calcium hydroxide or magnesium hydroxide exceeds its point of solubility it is precipitated in the pores and on the surface of the TBC electrode. Calcium or magnesium ions thus lost from the solution should be replaced by addition of calcium hydroxide or magnesium hydroxide; the solution should be stirred.

Following are the reactions at the cathode when the TBC electrode is fully discharged:



In the case of an electrode (of silver oxide, for example) that may be discharged during the coating reaction, the pH may be changed by the electrode reactions rather than by the evolution of hydrogen:



The opposite effect may be expected during coating of an anode—such as a cadmium electrode. The charging reaction of a discharged cadmium electrode may provide the necessary change in pH for precipitation. Coating of the cathode has been found generally preferable since coating of a cadmium or zinc electrode may result in early passivation.

The preferred parameters for calcium hydroxide films are electrolyte concentration of calcium acetate, 70 to 280 g/l (optimum remains undetermined); buffering concentration of calcium hydroxide, 1 to 2 g/l; current density, 75 to 155 mA/cm²; and coating time for 2-mil films, 10 to 15 min. The more the electrolyte is stirred, the better the coverage and uniformity of thickness of the film.

So far the coatings have been used only in conjunction with conventional separators; more experience is required. In some instances, coating of both anode and cathode may be desirable. Because the physical nature of the coating varies with the concentration of potassium hydroxide, more information is required regarding the concentration of the electro-

(continued overleaf)

lyte. Such separators should be satisfactory on various other plates for alkaline cells, and may be useful in other electrochemical devices such as metal-air cells.

Note:

The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$0.65)

Reference:

NASA-CR-84002 (N67-26175), Electrodepos-
ited Inorganic Separators

Patent status:

No patent action is contemplated by NASA.

Source: W. N. Carson, Jr., J. A. Consiglio,
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